Appendix A
Team Guiding Production of Volume 1

An interagency team (the Core Team) guided all aspects of and participated in the search and reading of the scientific literature, wrote the synthesis, and produced Volume 1. The team consisted of staff from the Washington State Department of Ecology, the Washington State Department of Fish and Wildlife, the U.S. Environmental Protection Agency and Sheldon and Associates, the consulting firm hired to assist with production. Additional Ecology staff served as authors (see the list of authors on the title page of this document). The editor was included on the Core Team in the later stages of production.

The Core Team included the following individuals:

Ralph Rodgers	U.S. Environmental Protection Agency
Katherine March	Washington State Department of Fish and Wildlife
Andy McMillan	Washington State Department of Ecology
Tom Hruby	Washington State Department of Ecology
Erik Stockdale	Washington State Department of Ecology
Teri Granger	Washington State Department of Ecology (coordinator)
Dyanne Sheldon	Sheldon and Associates
Kim Harper	Sheldon and Associates
Sara Noland	2N Publications (editor)

Appendix B
Characteristics of a Valid Scientific Process

The characteristics of a valid scientific process in the context of "best available science" are defined below, as quoted directly from WAC 365-195-900:

1. ***Peer review.*** *The information has been critically reviewed by other persons who are qualified scientific experts in that scientific discipline. The criticism of the peer reviewers has been addressed by the proponents of the information. Publication in a refereed scientific journal usually indicates that the information has been appropriately peer-reviewed.*

2. ***Methods.*** *The methods that were used to obtain the information are clearly stated and able to be replicated. The methods are standardized in the pertinent scientific discipline or, if not, the methods have been appropriately peer-reviewed to assure their reliability and validity.*

3. ***Logical conclusions and reasonable inferences.*** *The conclusions presented are based on reasonable assumptions supported by other studies and consistent with the general theory underlying the assumptions. The conclusions are logically and reasonably derived from the assumptions and supported by the data presented. Any gaps in information and inconsistencies with other pertinent scientific information are adequately explained.*

4. ***Quantitative analysis.*** *The data have been analyzed using appropriate statistical or quantitative methods.*

5. ***Context.*** *The information is placed in proper context. The assumptions, analytical techniques, data, and conclusions are appropriately framed with respect to the prevailing body of pertinent scientific knowledge.*

6. ***References.*** *The assumptions, analytical techniques, and conclusions are well referenced with citations to relevant, credible literature and other pertinent existing information.*

Information derived from one of these sources can be considered scientific information if it possesses the required characteristics shown in Table B-1.

Table B-1. Source types and characteristics of scientific information.

Sources of Scientific Information	Characteristics					
	Peer Review	Methods	Logical Conclusions & Reasonable Inferences	Quantitative Analysis	Context	References
A. Research. Research data collected and analyzed as part of a controlled experiment (or other appropriate method) to test a specific hypothesis.	X	X	X	X	X	X
B. Monitoring. Monitoring data collected periodically over time to determine a resource trend or evaluate a management program.	NA	X	X	Y	X	X
C. Inventory. Inventory data collected from an entire population or population segment (e.g., individuals in a plant or animal species) or an entire ecosystem or ecosystem segment (e.g., the species in a particular wetland).	NA	X	X	Y	X	X
D. Survey. Survey data collected from a statistical sample from a population or ecosystem.	NA	X	X	Y	X	X
E. Modeling. Mathematical or symbolic simulation or representation of a natural system. Models generally are used to understand and explain occurrences that cannot be directly observed.	X	X	X	X	X	X
F. Assessment. Inspection and evaluation of site-specific information by a qualified scientific expert. An assessment may or may not involve collection of new data.	NA	X	X	NA	X	X
G. Synthesis. A comprehensive review and explanation of pertinent literature and other relevant existing knowledge by a qualified scientific expert.	X	X	X	NA	X	X
H. Expert Opinion. Statement of a qualified scientific expert based on his or her best professional judgment and experience in the pertinent scientific discipline. The opinion may or may not be based on site-specific information.	NA	NA	X	NA	X	X

X = Characteristic must be present for information derived to be considered scientifically valid and reliable.
Y = Presence of characteristic strengthens scientific validity and reliability of information derived, but is not essential to ensure scientific validity and reliability.
NA = The characteristic does not apply to the source type. For example, monitoring data are not typically peer reviewed.

Appendix C

Methods Used for Searching and Reviewing the Literature

2.1 Searching the Literature

To begin the literature review for Volume 1, personal bibliographies were solicited from a small number of professionals known to have extensive libraries on wetlands in the Pacific Northwest. Other existing published reference lists were reviewed for relevant documents. In addition to the specified reference lists, computer searches were conducted of publicly available databases using a variety of keywords. Table C-1 lists the sources of reference lists and the names of the databases searched, as well as the approximate numbers of documents contained in each source.

Table C-2 lists the keywords that were used in the searches of computer databases. This list was developed by the Core Team and expanded based on comments from focus groups (see Chapter 1 for information on focus groups). The searches were done combining the word "wetland" plus one of the keywords. The words in the last column were used to exclude wetland types not covered by this report. Specific wetland types not found in Washington and known to be very dissimilar from Washington wetlands were also excluded, as were estuarine and marine wetlands.

Table C-1. Summary of reference lists and database searches for Volume 1.

List Source	Approx. No. Documents	Notes
Personal Bibliographies		
Dr. Paul Adamus, EPA	1,600	Broad range of documents
Dr. Tom Hruby, WA Ecology	600	Broad range of documents, many focus on wetland functions
Mary Kentula, EPA	170	Focus on wetland mitigation, management, policy effectiveness
Dr. Klaus Richter, King County	3,500	Focus on amphibians w/Pac. NW emphasis
Published Reference Lists		
Management recommendations for WA priority habitats: freshwater wetlands and fresh deepwater (Morgan 1998)	640	Focus on wildlife and aquatic habitats
Management recommendations for WA priority habitats: riparian (Knutson and Naef 1997)	550	Focus on riparian habitats, not necessarily wetlands
Managing for enhancement of riparian and wetland areas of the Western U.S.: an annotated bibliography (Koehler and Thomas 2000)	1,900	Broad application to western U.S.; many documents not relevant to Pac. NW
Classification and management of aquatic, riparian and wetland sites on the national forests of Eastern Washington (Kovalchik 2001)	400	Focus on eastside and forested areas
Effects of urbanization on pond-breeding amphibians: an annotated literature review (Ostergaard 2000)	100	Focus on amphibians and urban effects
Database Searches		
Keyword searches of various databases	9,800	Databases searched included Ovid, ProQuest, Biosis, Dissertation Abstracts, Agricola, Current Contents, Biological Abstracts
Total	**~17,860**	**Total includes an unknown number of duplicates among the various sources**

Table C-2. Keywords used in searching computer databases of literature.

Base Word	Keywords		Exclusions
Wetland	Aesthetics Agriculture Alkali Alluvial Amphibians Aquifer Recharge Arid Land Artesian Birds Bog Buffers Compensation Conservation Cumulative Impacts Development Disturbed Dynamic Economics Enhancement Erosion Farmed Fen Fish Floodplain Fluvial Functions Geology Geomorphology Grazing Groundwater Habitat Hydraulic Hydric Hydrology Hyporheic Industrial Inventory Invertebrates Irrigation Isolated	Land Use Landscape Maintenance Mammals Mapping Mining Mitigation Mollusks Monitoring Nutrients Perched Policy Public Access Recreation Regulation Reptiles Residential Restoration River Rural Seasonal Septic Slope Soils Spatial Stewardship Stormwater Transportation Corridors Urban Utility Corridors Values Variation Vegetation Types Vernal Pools (not Calif.) Water Quality Water Regime Wells Wildlife	Bottomland Hardwood California Vernal Pools Estuarine Intertidal Lacustrine Marine Mississippi Floodplain Mudflats Salt Marsh Saltwater

2.2 Reviewing, Sorting, and Prioritizing the Reference Lists

Lists resulting from the searches of the computer databases were compiled into a ProCite® database for the project. Documents from other sources found later in the project have been or will be added to the database at a later date.

All reference lists were reviewed by one or more of the Core Team members. From these lists, the Core Team selected those documents that were believed to be relevant to the project, based solely on the title of the article and its date. Those marked documents were then prioritized using a two-tiered system in which those considered most critical to the project were designated as those to be obtained first. Eventually, attempts were made to obtain all the documents on the lists that were believed to be relevant based on their titles. In addition, references were found while individual authors searched for subjects for which information was lacking. These references are provided in the list of references cited in the report but not all been entered into the database at this time.

For the most part, available documents from the past 10 years were used as the primary sources for this report. It was assumed that this most recent literature would incorporate relevant science from the preceding years. Older documents were used in instances where they had not been superseded by more recent studies.

Most of the documents used as sources for Volume 1 meet the criteria for BAS in WAC 365-195-900. The vast majority of the sources were peer reviewed. Conference proceedings and other "gray" literature were occasionally used and in some cases had not been peer reviewed. Peer reviewers are asked to judge the reliability of the sources used, including any gray literature.

In some cases we have cited unpublished data collected by Ecology staff during the calibration of the Washington State Wetland Function Assessment Methods and the State Wetland Rating System. These data have not been published in scientific journals. However, the assessment methods and the wetland rating system which the data support have been peer reviewed.

2.3 Obtaining and Archiving the Documents

Of the more than 17,000 documents on all lists used, copies of over 1,400 documents were obtained after review of the titles and dates, as prioritized using the screening process described above. Paper copies of most of the articles reviewed for this project will be held in an archive at the Washington State Department of Ecology when the project is completed. The archive will be accessible to the public by appointment. A number of theses, dissertations, and books are not included in the archive due to copyright laws and the limited options for purchasing such documents. In these cases, borrowed copies were used and returned, with only the title pages and tables of contents copied for the archive.

2.4 Reading Documents and Writing the Report

References were skimmed and those dealing with Washington or the Pacific Northwest and with practical application to the management and protection of wetlands were prioritized for reading. Searches of the database or the original articles were used by each author to write their portions of the draft document.

Preliminary drafts of Volume 1 were reviewed by the Core Team and selected agency staff, and revisions were made. The revised draft is now being circulated to a group of peer experts as well as anyone who wished to review it. The comments will be compiled and reviewed by the Core Team and further revisions will be made. Volume 1 will be finalized after a draft of Volume 2, providing options and recommendations for managing and protecting freshwater wetlands, is prepared for public review.

Appendix D
Reviewers of Volume 1

This draft of Volume 1 is currently out for review. The final document will contain a list, in this appendix, of all those who provided written comments on the draft.

Appendix E
Methods for Organizing and Grouping Wetland Information

The following information is adapted from Hruby (1999).

Many groups including federal and state agencies have been developing techniques for analyzing wetland functions ever since wetlands were first subject to regulation in the 1970s. The motivation for developing such methods has primarily been the need to predict the effects of alterations to wetlands and set appropriate requirements for compensatory mitigation.

Methods for organizing knowledge about wetlands have been called classifications, categorizations, characterizations, ratings, assessments, and evaluations. These groupings are meant to indicate the type of information a method provides. Unfortunately, the scientific community has been sloppy in the use of these terms to the extent of misnaming many of the analytical tools developed. Users of methods developed for analyzing wetlands should be aware of some of these problems with definitions. Standard definitions for analytical methods based on Webster's Seventh New Collegiate Dictionary (1963) are described below.

Classification/categorization—a systematic grouping into categories according to established criteria or shared characteristics. The two most common wetland classifications are those of Cowardin et al. (1979), which is based on shared characteristics of vegetation and water regime, and the hydrogeomorphic classification (Brinson 1993), which is based on shared characteristics of geomorphic setting and water regime. The criteria used for grouping are generally not linked to specific functions, and thus classifications are not true methods for assessing functions. They can, however, provide a basis on which to develop assessment methods (Brinson 1995).

Characterization—a grouping by a distinguishing trait, quality, or property. For example, the Oregon method (Roth et al. 1993) characterizes wetlands by the properties of "provides" a specific function; "has the potential to provide" a function; or "does not provide" a function. These are three distinct attributes that give some information about whether a wetland performs a function, but no information is generated about levels of performance. The Washington State Wetland Rating System is a characterization based on five categories (sensitivity to disturbance, rarity, importance, ability to replicate, and relative level of functioning) (Ecology 1991).

Rating—classification based on a grade. Ratings usually group wetlands using the qualitative grades of high, medium, or low on a variety of scales such as the performance of a function or its value. The wetland evaluation technique or WET (Adamus et al. 1987) is probably the most widely used rating method.

Assessment—an estimate or determination of importance or value. This is the first level at which numbers are generated to represent an estimate of performance, value, or functional value of a function. All commonly used "rapid" numeric methods fall into this category. These methods only provide an assessment that is relative to some predetermined standard. They do not provide an assessment of actual levels of performance or value. The term "assessment" is one of the most commonly misused words in the lexicon of wetland scientists. Almost any method developed is now called an assessment, regardless of whether it might actually be a categorization, a rating, or a true assessment.

Evaluation—a determination or fixing of value. The fixing of value for any item is based on having a generally acceptable currency. Up to now the only currency used has been monetary, and evaluations of wetland functions have most often tried to generate dollar values based on different types of economic models such as the travel cost method, random utility model, hedonic techniques, contingent valuation method (Titre and Henderson 1989, Lipton et al. 1995), or willingness-to-pay method (Farber and Costanza 1987).